

Media Processors for Advanced Handheld Devices

NVIDIA GOFORCE

The mobile phone of 2004 is evolving into a full fledged multimedia device where voice becomes just one of many different capabilities offered. From high-resolution digital photography to fullmotion video and interactive games, mobile phones are now used for a myriad of multimedia applications. NVIDIA® GoForce™ multimedia processors deliver megapixel digital photo resolution, video playback and capture, richer graphics, better image quality, and longer battery life for these advanced devices. The GoForce 4000 offers a host of advanced features for mobile phones, including support for three megapixel (MP) image capture, high-quality video capture and playback, accelerated graphics for gaming, and NVIDIA nPower technology that enables all these multimedia features while minimizing impact on battery life.

THREE MEGAPIXEL DIGITAL CAMERA SUPPORT FOR PHOTOGRAPHIC QUALITY IMAGERY

Digital cameras are quickly becoming a standard feature on today's mobile phones. With GoForce 4000, the bar has been raised to an even higher standard—3MP film-quality imaging, higher than a majority of the standalone digital cameras in use today. In addition to this new level of image quality, other features, standard in digital cameras, are now possible on your mobile phone thanks to GoForce media processors. Removable storage cards and 8x digital zoom now allow you to use your mobile phone as your primary digital camera—for taking, storing, sharing, and printing your high quality photos. GoForce media processors also offer real-time capture, storage and viewing of multiple digital images on your phone, for added convenience when you want to quickly view all the images you have taken.

FULL 30 FRAMES PER SECOND VIDEO CAPTURE AND PLAYBACK

When recording or playing video content, frame rate is a key factor in determining the visual quality. The higher the frame rate the better. The GoForce 4000 media processor is capable of both encoding (recording) and decoding (playback) at a fast 30 frames per second, better than most video cameras, delivering smooth and jitter-free high quality video. The media processor incorporates a number of filters which further improve the quality of this content. The GoForce media processors do all this at a very high resolution on a mobile phone (CIF resolution, 352 x 288). The user sees the result of this quality when viewing streaming video on their phone or when they use it as a mini camcorder to capture streaming video. The GoForce 4000 also allows for simultaneous encode and decode that can be used for applications like video conferencing, which records and sends your image, while playing back the image of the person you are video conferencing with.

BREAKTHROUGH NVIDIA NPOWER TECHNOLOGY DELIVERS INDUSTRY-LEADING BATTERY LIFE

Multimedia functions, like video and imaging, require a significant amount of processing. If all these functions had to be performed by the phone's main processor, battery life and performance would suffer dramatically. GoForce media processors have been architected specifically to address this issue—maximizing multimedia processing performance while minimizing power drain on the battery using NVIDIA nPower technology. By offloading the main processor and running these multimedia applications on the media processor, GoForce can significantly reduce the power required to run these applications—while improving the image quality on the display. For example, applications run on the GoForce 4000 typically require 90% less power than running the same application in software. The GoForce 4000 even saves power in standby mode by intelligently shutting down areas of the processor not being used.

INDUSTRY TECHNOLOGY LEADERSHIP

The hallmark of every device in the NVIDIA GoForce family is to provide a high-performance, visually rich multimedia experience on mobile phones and handheld devices. This includes supporting the most demanded features and capabilities, directly interfacing to a vast array of display panels, and implementing innovative design techniques, both inside the chips and at the system level, which result in high performance and long battery life.

NVIDIA also offers the GoForce 3000 media processor, a cost-effective solution that provides a subset of the multimedia capabilities found in the GoForce 4000, while still delivering an array of new high resolution video and imaging features to mobile phones.



FEATURES		BENEFITS
PHOTOS	Megapixel JPEG Codec	Up to three megapixel high-resolution camera support makes it possible to capture photographic quality images with your mobile phone that can be printed in the standard 8 x 10 inch (20.3 x 25.4 cm) size, or displayed at high resolution on a computer monitor.
	8x Digital Zoom	High-quality digital zoom allows users to crop and zoom into an area of interest. This feature brings camera phones up to par with standalone digital cameras.
VIDEO	MPEG-4 Codec	Enables full motion 30 fps video record (encode) and playback (decode) applications for your mobile phone. The new class of applications for mainstream handsets includes video-on-demand, camcorder capabilities, streaming video playback, and video conference calling.
STORAGE	SD/SDIO	Support for removable (SD) storage, allows the user to take video and imagery captured on the camera phone and transfer directly to a PC or similar device equipped with an SD reader. SDIO enables add-in functionality like Bluetooth.
PERFORMANCE	Embedded Memory	640KB of 64-bit wide dedicated SRAM memory enables on-chip processing of imaging, graphics and video applications resulting in low system power consumption. High-resolution displays are supported without the need to access external memory, reducing the power required to output to the display.

NVIDIA GOFORCE 4000 SPECIFICATIONS

HIGH RESOLUTION COLOR DISPLAY

- Fast switching between main/sub-LCD
- Hardware support for sub-LCD display
- 18-bpp panel support
- Support for VGA (640 x 480) LCDs

64-BIT 2D GRAPHICS ACCELERATION

- BitBLT with 256 3-operand raster operations
- Video scaling with range of 8x expansion to 1/60th contraction
- Mono and solid pattern
- Mono-to-color expansion
- Mono source/pattern transparency
- · Destination read/write color transparency
- All angle (Bresenham) line draw
- Rectangle fill

FLAT PANEL (LCD) INTERFACE

- Direct interface to LCD drivers with embedded memory
- Built-in timing generator
- Color FRC S-STN at 4, 8, and 16 bits/clock
- Color PWM S-STN at 9 and 12 bits/clock
- Color TFT at 9, 12, 16 and 18 bit/clock
- Partial pixel per clock mode
- Up to 16-level FRC and up to 4-bit spatial dithering
- CPU, RGB, Serial, NEC M-CMADS, AMLCD, LTPS, and Sharp ULC display support
- · Support for over 75 popular displays

MPEG-4/H.263 HARDWARE CODEC

- CIF encode or decode at 30fps
- Full duplex 30fps @ QCIF
- MPEG-4 Simple Profile, Level 1, 2, 3
- H.263 support
- Back-end MPEG-4 video processing including hardware color space conversion and image scaling
- Deblocking and deringing filters to reduce the visibility of compression artifacts during playback

JPEG HARDWARE CODEC

- Megapixel image preview at 15fps
- Motion JPEG capture/playback for VGA resolution at up to 30fps
- Low shutter lag
- · Composite, framing, and overlay
- Thumbnail support (store both image and thumbnail in same file)
- · Hardware Huffman decode for JPEG
- Programmable Q-table
- Hardware DCT, RLE, and Huffman encoding

VIDEO INPUT

- 3MP camera module support
- ITU-R 656-compliant 8-bit interface
- Horizontal scaling with horizontal averaging and low-pass filtering
- Vertical averaging
- Synchronous serial bus (SSB) for camera control and programming
- 72MHz output to drive the camera master clock
- YUV422 to RGB565 color space conversion
- · Single and double buffering support
- Double buffering synchronization with graphics controller
- Fine-grained digital zoom, up to 8x

GRAPHICS CONTROLLER

- Hardware rotation (90°, 180°, 270°)
- Flip and mirror
- Partial display support (any size/position)
- Triple 6-bit look-up-table
- · Overlay support
- Encode predefined region of display

INTEGRATED 640KB 64-BIT SRAM

 640KB of 64-bit wide on-board frame, video, and transactional buffers minimize external bus traffic and significantly reduce system power

32-BIT FLEXIBLE HOST BUS INTERFACE

- Indirect and direct addressing support
- 8/16/32-bit asynchronous interface for baseband processors (ARM based)
- MDB-style (Dragonball) 8-bit and 16-bit mode
- Burst mode support
- Fixed and variable latency host bus

SD/SDIO HOST CONTROLLER

- 1 bit and 4 bit SD/SDIO
- Support for storage or Bluetooth cards
- Store directly to SD card in continuous JPEG encode mode

CLOCK OPTIONS

- On-chip oscillator for 2 to 6MHz crystals
- Digital bypass mode for external clock sources (e.g. baseband or CPU)
- Low-power relaxation oscillator
- On-chip PLL with VCO range of 50MHz to 100MHz

ADVANCED POWER MANAGEMENT

- Fully-static CMOS technology
- Low-leakage 0.15μ process
- Individual module enables
- Automatic shut-off of unused pipeline stages

PACKAGING & POWER

- 168-pin BGA, 10 x 10mm, 0.65mm ball spacing, 1.2mm height (GoForce 3000 compatible with one extra row)
- JTAG boundary scan
- 1.425-1.575V core, 1.71V to 3.60V I/O



